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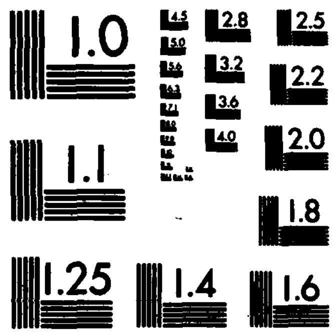

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THE ROLE OF THE AIR FORCE ENVIRONMENTAL HEALTH NURSE IN LONG-TERM HEALTH PROBLEMS IN NATURAL DISASTERS

by

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THESIS

Presented to the Faculty of The University of Texas Health Science Center at Houston School of Public Health in Partial Fulfillment of the Requirements for the Degree of

MASTER OF PUBLIC HEALTH

THE UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT HOUSTON
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PREFACE

Throughout this paper the title Environmental Health Nurse (EHN) is used. However, in all cases the term Environmental Health Officer (EHO) should be understood as being interchangeable.

The author wishes to thank Colonel M.M. Gillane, Brooks AFB, Texas; Dr. D. Menglesdorff, Ft. Sam Houston, Texas; Dr. C. Eifler and Dr. A.H. Holguin, UTHSC, School of Public Health, San Antonio for their help and support during this project.

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ABSTRACT

United States Air Force Environmental Health Nurses (EHNs) are required by regulation to provide support during peacetime natural disasters. Additionally, they are also expected to monitor shelter safety and decontamination procedures during armed conflict. Therefore, it is proposed that EHNs take an active part in civilian natural disasters, lending their expertise to the local community while providing the Air Force with valuable disaster-related public health knowledge applicable to wartime medical readiness.

It is further proposed that EHNs perform epidemiological research on the long-term health effects of natural disasters. Four assessment tools are provided which are designed to measure symptomatology as related to disaster experience and demographic characteristics. Two methods of classifying natural disasters are explored which can standardize and simplify comparisons between dissimilar catastrophic events.

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INTRODUCTION

In the field of medical readiness, the Air Force Environmental Health Team, composed of the Environmental Health Nurse (EHN) or the Environmental Health Officer (EHO), the Bioenvironmental Engineer (BEE) and enlisted technicians, is tasked to "...support the medical facility response to peacetime industrial accidents...and natural disasters" (AFR 160-25:4-3). Meanwhile, the field of public health as a whole has recognized that "disasters pose major threats to public health far beyond the early recovery period, and these events can be fruitfully investigated with an epidemiological approach" (Logue, Hansen and Struening, 1981:78). This thesis proposes that both civilian and military communities would gain much in utilizing Air Force Environmental Health Nurses in an investigative capacity during such events.

The Air Force is particularly well equipped to respond to civilian natural disasters because military air transport provides rapid, massive response; furthermore, many Air Force bases are located in disaster-prone areas. Additionally, the Air Force plans to assign an EHN/EHO to every Air Force base world wide. These

epidemiologically trained officers will be available to assist the community in the long term research of disaster related health effects regardless of duty assignment, thereby contributing to public health research over an extended period of time.

Disaster research will be of benefit to the military community in contributing to skills in war readiness. Military medicine has become particularly concerned about problems relating to the use of nuclear, biological and chemical weapons. All Air Force medical facilities stage at least two mass casualty exercises per year to practice and evaluate their intervention procedures. However, if EHNs can be involved in conjunction with civil relief agencies within the community, actual situations could be evaluated from a public health standpoint, and information thus gained could be disseminated to all Environmental Health Teams.

As relatively new members of the medical readiness support team, EHNs need to quickly acquire public health experience related to combat situations within a peacetime setting. Our early theories of health effects of natural disasters were primarily based on experiences gained during wartime; accordingly, public health interventions needed during armed conflict can be further

refined by planning for, responding to and analyzing health effects of civilian natural disasters in a comprehensive, systematic manner.

For purposes of this thesis, a disaster will be defined as "...a sudden, extraordinary calamity or catastrophe which affects or threatens health..." (Foege, 1980: 1824), including tornadoes, hurricanes and floods, heat waves, volcanoes, earthquakes and snowstorms.

PART I

MILITARY INVOLVEMENT DURING DISASTERS

According to Anderson (1970), the military is expected to provide emergency assistance to civilian communities stricken by natural disasters. Describing the extent and timing of aid, he observed that:

> Usually, the bulk of this aid is given by the military during the emergency period of a disaster, i.e. within the first three or four days following the impact of a disaster agent, when the greatest demands are imposed on the recovery capabilities of an affected community... (They) along with other emergency-activated organizations may become involved in one or several of the following emergency functions: warning, search and rescue, mass feeding and shelter preparations, emergency medical treatment of victims, restoration of minimum community services and maintenance of order... The structure of the military organization...plus the fact that they are geared for rapid emergency mobilization and response, enable them to be of immeasurable aid to communities struck by disaster (p. 416).

Although the author has personal knowledge of Air Force aid and relief during natural disasters (e.g. Hurricane Camille - Keesler AFB, Mississippi, 1969; Lubbock Tornado - Reese AFB, Texas, 1970; Wichita Falls Tornado - Sheppard AFB, 1979), and has, as an Air Force nurse, provided health care in a refugee camp (Campo Libertad, Fort Walton Beach, Florida, 1980), there has been very little in civilian or military literature to document,

much less analyze, these or other such interventions. The Air Force Association magazine made mention of disaster relief work only in its coverage of Reserve Units, where it credited the 304th Air Reserve Wing of Portland, Oregon with saving 61 lives during the Mt. St. Helen's eruption (Schlitz, 1981:49). However, during 1979 and 1980, the Air National Guard responded to 256 natural disasters, including 56 forest fires, 88 floods, 23 tornadoes, 70 wind, snow and ice emergencies, 7 hurricanes and 12 miscellaneous, including volcanic eruptions and droughts (Chief, National Guard, 1979; 1980).

A possible reason for the lack of information about military involvement may be due to a sociological theory of civilian-military interaction proposed by Anderson:

> Although military organizations are expected to assist civilian communities during times of natural disaster, this assistance is expected to be secondary to the effort launched by civilian governmental structures and organizations, and that noncivilian means should be turned to only if it appears that civilian resources will be inadequate...Military authorities usually wait until they are invited guests before they become involved in a disaster-struck civilian community, and once they receive such an invitation, they generally work under the authority of civilian officials (1970:417).

Thus, it appears both sectors of society have a reluctance to advertise military contributions. The civilian

community, in calling upon the military, may feel it is admitting failure, thereby preferring to downplay the military importance to its recovery. The military, on the other hand, which sees its primary mission as war readiness, will be less likely to spend editorial space on what is perceived to be a peripheral function. While one would assume that disaster relief would heighten the military's image in the civilian sector, there is evidence that such publicity tends to backfire into fears of martial law or even a military takeover (Quarantelli and Dynes, 1972). While American citizens recognize the military's potential usefulness in emergency situations, they are highly ambivalent and fear its power, according to Anderson. Disaster-caused medical emergencies may suspend immediate civilian trepidation, but rapid return to the status quo occurs when the crisis is over. Therefore, it appears that both sectors remain unprepared to coordinate with one another or share research on a routine basis.

Tidemann(1980:47) asserts that medical problems created by war differ little from those created by natural disasters. The public health problems that EHNs are likely to encounter during wartime are:

1. The three causes of pediatric casualties:

(a) diarrhea

(b) pneumonia

(c) protein-caloric malnutrition (in underdeveloped or severely wartorn areas)

2. Depending on the prevailing public health practices of the community, these conditions may also be common:

   (a) tuberculosis

   (b) intestinal helminth infections

   (c) measles

   (d) malaria

   (e) accidents, particularly burns

3. Safety of food will require much attention, particularly if refrigeration and/or transport are interrupted.

4. While the Bioenvironmental Engineer will be responsible for water quality and sanitary waste disposal, the EHNs will need to carefully evaluate for immunization needs, and rapidly investigate rumors of communicable disease outbreaks (after Tidemann, 1980; de Ville de Goyet, 1979).

Simultaneously, all medical personnel will be faced with the following operational problems:

1. Political problems:

   By convention, international law and justice, the right to receive, the right to give medical relief and humanitarian assistance during armed conflicts are well established. In reality, it is not quite so. During internal conflicts, in areas controlled by national resistance movements, and in occupied territories, medical relief to the civilian population will notoriously create both formal and practical problems that have to be met with great diplomacy and tactical skill (Tidemann, 1980:50).

2. Safety problems:

   The Security Police section will need to be engaged to help control entry to the medical facility, especially during decontamination procedures. Also, its aid will be needed to manage the inevitable convergence of non-victims, as well as guarding against enemy infiltration.

3. Communication problems:

   The public information office will be invaluable in relaying patient status quickly and efficiently, and can thereby help decrease convergence behavior in a critical area. This office can, in addition, assist the EHN in quelling unfounded rumors of communicable disease outbreaks, freeing

them to continue investigation of the most pressing problems.

4. Battle-related problems will complicate health care delivery in ways to which few public health practitioners have been accustomed. Blitzkreig, moving front lines, guerrilla terrorism, strategic bombing and rocketing activities will pressure some shelter administrators to enlist EHNs to work trauma teams. This must be avoided if at all possible, since there are few military specialists capable of advising on shelter and health consequences while there are many who have trauma training.

5. Organizational problems:
Tidemann asserts that "The effect on any medical institution will depend upon cooperation with other institutions and organizations" (1980:51), thus freeing medical personnel to concentrate on the mission rather than obliging them to establish a functional chain of command during already chaotic circumstances.

Fagerlund reported that in 1973 the International Symposium in Mainz, West Germany defined a medical disaster as a "natural or other event resulting in more casualties and health problems than a health system is routinely prepared to deal with" (1980:117). He feels that the similarity with military operations is obvious when he asserts that, "Although two battles are not alike, experience throughout centuries has taught us that a functional organization is the best way of meeting extraordinary circumstances" (1980:117).

Cooperation between the military and civilian communities can decrease morbidity and mortality regardless of the type of disaster. The EHNs can provide valuable assistance to both communities by utilizing their professional training in natural disasters. As Tidemann states "Efficient work depends partly upon good planning. Good planning and performance demands experience, surveying assessment and reassessment" (1980:51).

To conceptualize planning for the health needs of a disaster, regardless of its type, Heimann suggests the process be examined under these headings:

1. Knowledge
2. Planning

3. Survey
4. Organization and action
5. Collection and evaluation of experiences
6. Application of what has been learned (Øyen, 1980:119)

A proposed role for the EHN will be suggested under each of these topics, including a plan for rapid, accurate data collection to monitor long-term health changes after a natural disaster. It is hoped that good public health practice combined with the unique possibilities afforded Air Force personnel to respond quickly to a crisis will provide disaster research with comprehensive and accurate data so that the medical community can tune its response to the person, place and time where intervention will prevent excess morbidity and mortality, as well as inefficient use of limited resources.

BACKGROUND KNOWLEDGE FOR THE EHN

In examining the knowledge requirements for EHNs to function during and after a disaster, it may be more appropriate to begin with what a disaster is not. It is not an uncontrollable, panic-stricken hoard of citizens packing emergency shelters (Hartsough, 1982). As a matter of fact, the belief that people will panic in the face of great danger is such a widespread myth that it is believed to influence community officials to act unreasonably slowly and cautiously in authorizing warning bulletins. The persons who do flee are primarily transients and tourists; residents tend to prefer to take the chance and stay in their homes. During Hurricane Carla in 1961, although Gulf coastal residents had at least four days' prior warning, 35% remained in their own homes and another 22% stayed in homes of friends and relatives (Quarentelli and Dynes, 1972:67).

Family, friends, and organized church groups seem to be the first place victims turn to for help. They seek out the American Red Cross or civil defense agencies only as a last resort. Dacy and Kunreuther (1969) assert that victims will choose to stay at homes of complete strangers and will find shelter on their

own by the first night after the disaster. During an evacuation of the San Fernando Valley in 1971 to protect residents from the threat of weakened dams, only seven percent sought public shelter. This pattern echoed the American Red Cross experience during Hurricane Betsy where only 19% of the 178,548 families who suffered loss were in some way rescued or assisted by that agency (Quarantelli and Dynes, 1972).

The Statistical Bureau of the Metropolitan Life Insurance Company reported that natural catastrophes caused an estimated 9,300 deaths, slightly less than one-fifth of the total of 50,000 deaths from all catastrophic accidents from 1941-1980. The death toll from natural catastrophes was highest in the 1950s (about 2,700) and the lowest was in the 1960s (about 2,000). The number of deaths recorded in 1971-1980 exceeded 2,300, ranking third among causes of catastrophic fatalities for that decade. Of the 38 major disasters which claimed 100 or more lives, 20 or 52% were natural disasters (Metropolitan Life, 1982(b):3-4).

Natural disasters claiming 25 or more lives totaled nine events, which accounted for one-third of accidental deaths between 1977-1980.

In the developed world, mortality is not an

accurate indicator of disaster severity. In the United States, the average death to housing loss ratio is estimated below:

Hurricanes	2.71deaths/100 houses destroyed
Tornadoes	5.55/100
All Floods	3.57/100
Flash Floods	5.15/100
Total Disasters	4.00/100

(Wright, et al., 1979)

These estimates illustrate that the highest death ratios occur in disasters where the warning times are the shortest, notably tornadoes and flash floods.

Natural disasters can wreak havoc with Environmental Health Services. Transportation failure, power outages, and damage to civil engineering will affect water supplies, waste water disposal, solid waste handling, food handling, and home sanitation (Pan American Health Organization, 1982). Vector control becomes a problem when disruption of established control programs occur due to disorganization and personnel shortages. Some researchers feel that viewing the disaster as the cause of vector-borne illnesses ignores the fact that in the underdeveloped nations, this is an endemic problem; similarily, in the developed nations, these problems

arise when established programs are for some reason suspended in favor of less efficacious efforts such as mass vaccination (Lechat, 1979; deVille de Goyet and del Cid, 1976).

The chronology of a disaster includes five phases. Warning, which may be long or short, depending on the type of disaster and the sophistication of meteorological equipment and the decisiveness of community officials. The impact phase is the time frame where the actual deaths, injuries or destruction occur. Lifesaving measures take place during the emergency phase, which, in turn, is divided into two parts: first, emergency self-help occasioned by initial isolation; second, outside rescue and relief personnel. During the rehabilitation phase, essential routine services are delivered to temporary facilities, e.g. water trucks supplying emergency hospitals and shelters. Environmental and sanitation interests are priority concerns during this time (Garb and Eng, 1969). Finally, the event moves into the reconstruction phase, the time when a community often needs the most assistance; according to several researchers this is the most important time to offer counseling and rehabilitative services, and to study long-term health effects as they relate to experiences during this time

(Logue, Melick and Hansen, 1981: deVille de Goyet, 1979; Lifton and Olsen, 1976).

Historical examples of health problems of specific types of disasters will be reviewed to familiarize EHNs with the variety of problems involved.

Tornadoes

Between 1916-1980 there have been 25,968 tornadoes in the U.S.,resulting in 11,301 recorded deaths. The most deadly tornado on record killed 689 people on March 18, 1925 when it swept a 220 mile path through southern Missouri, Illinois and Indiana (NOAA Fact Sheet, 1981). During 175 days of 1981, 772 tornadoes were reported which killed 24 people and injured 792 others. Property damage exceeded $500 million. Mobile homes remained the most vulnerable structures, as over 550 were damaged or destroyed. Tornado storms involving mobile homes alone accounted for 14 deaths and 107 injuries.

The tornado season starts in March and tapers off in August, with May and June being the most dangerous months. Texas recorded the most tornadoes in 1981 with 176 convirmed sightings, leading to one death and 83 injuries. Oklahoma reported fewer than half that many sightings, but sustained six deaths and 100 injuries. Florida's 61 tornadoes caused no deaths with 33 injuries,

while Kansas reported 39 sightings leading to one death and 42 injuries (NOAA Storm Data, December 1981).

On April 19, 1979 the Red River Valley suffered a series of tornadoes which left 56 dead and 1,916 people injured. Between 3:30 and 3:40, the first tornado hit Vernon, Texas, leaving 11 dead and 60 injured. By 5:00 PM Lawton, Oklahoma was struck and reported three fatalities and 109 injuries. Meanwhile, Wichita Falls had been placed on a Tornado Warning, so by the time the storm hit at 6:00 PM, the siren had sounded three times, with radio and television warnings being made for citizens to take immediate cover. The advanced warning time has been credited with saving many lives; although 2,934 dwellings were destroyed and 1,010 sustained major damage due to 200 mph winds, the death toll of 47 city-wide was relatively low (NOAA, January 1980).

Glass, et al. (1980), surveyed the city of Wichita Falls, where a total of 7,759 persons suffered some kind of loss. They noted that 51% of the serious injuries and 60% of the traumatic deaths took place in vehickes. Of those who were injured, 77% entered their vehicles expressly to outrun the tornado. In analyzing 59 of the hospitalized injuries, they found that 35.6% suffered fractures of the extremeties, 18.6% suffered rib

fractures with pulmonary complications, 13.6% suffered either head trauma, lacerations and abrasions, or miscellaneous fractures, while 5% suffered heart attacks.

Risks of injury by location were:

Single family homes:	3.2/1,000
Vehicles:	23.2/1,000
Public Buildings:	6.1/1,000
Mobile Homes:	85.1/1,000
Apartments:	1.3/1,000
Average Risk:	6.5/1,000

(Glass, et al., 1980:737)

While improved weather forecasting and advanced warning time were credited with decreasing the number of deaths for the city, the mortality rate would have been even lower if victims had stayed home or abandoned their cars to escape the storm; the homes of 11 of the vehicular victims sustained no major damage (Glass, 1980; MMWR, 1979).

When Air Force personnel are newly assigned to tornado-prone areas, they should be required to attend a yearly tornado-safety briefing for themselves and their families. Also, the housing referral office should warn prospective mobile home renters of the increased risk of injury. The Base Commander may want to investigate

the possibility of putting mobile home parks in tornado risk areas off limits to military personnel unless there are adequate underground shelters on the premises.

Hurricanes and Floods

Between 1975-1977 flooding accounted for 512 deaths in the United States. The most common type of flooding is the rainstorm-river flood, followed by the coastal flood caused by storms, notably hurricanes. Snowmelts, ice thaws and floods from structural failure also cause much loss of property and, depending on the suddenness, considerable loss of life. The most destructive storm has been considered Hurricane Agnes in 1972. Although she matched 1979's Hurricane Frederic for amount of damage done, the Agnes' flash flooding caused the loss of 118 lives, as opposed to 5 deaths for Frederic.

While Agnes never exceeded the minimum hurricane intensity, the storm was exceptionally large; the relatively slow movement allowed it to pick up a great deal of tropical moisture so that when it hit land, it caused flooding from Georgia to New York.

Storm rainfall during June 18-25 varied from a total 10 cm to 48 cm. Washington D.C. received 28 cm

of rain in less than 18 hours (Bolt, et al., 1975:277). The most devastating effect of the hurricane from a public health viewpoint was the flood that took place at Wyoming Valley, Pennsylvania. Agnes led to a mass exodus of 120,000 people, and caused flooding of all but 20 of the 6,000 homes in the city of Kingston, Pennsylvania. Melick (1978) found increase in hypertension in the males of that area, while Logue, Hansen and Struening (1979) found emotional distress had lasted for an average of two years in their sample, while physical symptoms lasted two years for the males and three years for the females.

Another widely studied flood occurred in Buffalo Creek, Pennsylvania, in February 1972. The event was termed a natural disaster, because it was set off by heavy rains, but it was also a technological disaster in that the rains caused a coal waste dam to give way, killing 125, leaving 4,000 homeless in less than one hour. The accompanying coal dust ruined farm and garden land, as well as homes. Several researchers have documented severe mental problems due to the suddenness of the event, prolonged reconstruction time, and a total loss of a sense of community (Lifton and Olson, 1976; Titchener and Kapp, 1976).

From an environmental health perspective, floods

are extremely detrimental to home sanitation. Besides wreaking structural damage, they contaminate water and food supplies and disrupt power, heat, fuel, water supplies and waste water disposal (Pan American Health Organization, 1982). For example, three major environmental problems followed the floods caused by Hurricane Agnes:

1. A potential outbreak of California encephalitis which was averted through extensive spraying of flooded areas in 12 counties.
2. Nearly 4 million kilograms of contaminated beef and poultry had to be destroyed.
3. The silt resulting from the flooding mixed with raw sewage; a potential respiratory health problem arose when this contaminated silt dried and became a fine dust covering the affected area (Logue, Melick and Hansen, 1981:142).

Heat Crisis

Heatwaves qualify as disasters when the episode is superimposed on an already hot season. Metropolitan Life (January-March 1982:5) stated that the declining trend in fatal home accidents was interrupted in 1980 by the large number of heat-related deaths resulting from

the severe and prolonged heatwave during the summer of that year.

The health problem known as a heat island occurs near urbanized areas where medium-sized buildings and parking lots predominate. Observed temperature differences are closely related to population density, with the more dense settlements showing the most heat surplus. Large buildings in the area expose more surface to solar radiation, and have a proportionately higher heat storage capacity. Wind speeds are often decreased due to increased surface roughness of building materials (Runnells, et al., 1972). Effective ventilation is further decreased because rooms with only one opening have access to only 15% natural ventilation. Architectural design, combined with power failures in cities, exacerbate the heat load problem (Lowry, W.P., 1969).

The warmest temperature is, therefore, normally observed near the center of the city, with a strong gradient decline in the suburban areas. The magnitude of the gradient varies with the prevailing meteorological conditions: clear skies, light surface winds and low humidity are favorable for a well-developed nocturnal urban heat island (Clark, 1972).

Schuman (1971) investigated patterns of urban heatwave deaths in New York and St. Louis during July 1966. While he noted both cities had excess deaths during the heatwave, only St. Louis coded them by heat-related causes on the death certificates. However, this practice was adopted only after the second week in July, during which time a nationally televised all-star baseball game showed both spectators and players collapsing from the heat. New York coded the deaths as being due to underlying cardiovascular causes, but showed similar excess death rates corresponding to the number of days over 90°F. A total of 1,181 persons in New York and 618 persons in St. Louis were statistically categorized as excess deaths for July (Schuman, 1971:62). The group at greatest risk appeared to be white females in New York and non-white females in St. Louis. After the Center for Disease Control in Atlanta ruled out a summer influenza outbreak, it was postulated that the stagnant warm and polluted air apparently caused a rise of 84.2% in respiratory deaths.

Schuman feels that several simple indices could have alerted public health officials in both cities that heat-related deaths were on the rise. For example,

St. Louis averages 20 cardiovascular deaths per week. For the week ending July 9, the rate was 47. On July 5 and 6 alone, 18 such deaths were recorded. As this occurred one week before the televised baseball game, warnings could have been issued and medical facilities alerted. Inner city, rather than airport weather stations, isothermal mapping, and census tract analysis of mortality patterns could also have prepared city services.

In 1980, the Kansas City EMS tried a new technique, that of cooling all victims at the scene and continuing the cooling during transport. They used showers, ice, garden hoses with no evidence hypothermia, cardiac or respiratory problems (Allexenberg, 1981).

It has been postulated that urban crime may be an environmental health problem during heatwaves, as fears of physical harm or looting prevent the elderly from leaving their homes to seek cooler shelter. Buildings in poorer, older neighborhoods are not only not air-conditioned, but are not insulated, especially at the roof, causing mortality among the isolated elderly (Biery, 1980).

Volcanoes

The most recent and best studied volcano in recent history is the Mt. St. Helen's volcanic eruption of May, 1980. While considered a moderate eruption by geologists, only three other volcanoes in the past century have surpassed Mt. St. Helen's in magnitude in the western hemisphere. This type of volcano found in the Cascades is explosive in contrast to the effusive type (e.g. found in Hawaii) which produce very fluid lava. The cascade location produces volcanoes that can cause widespread destruction with its accompanying earthquakes, mudflows, and floods (Baxter, et al., 1981: 585). The blast destroyed 150 square miles of forest, killing vegetation and wildlife; damages reached more than $1.8 billion in property and crops (Perry, 1983:38).

Although the death toll was 62, Buist (1982) feels that the fatalities would have been higher if the eruption had not occurred on a Sunday when loggers were not on the mountain and the Governor and U.S. Forest Service had not insisted on keeping the area closed to the public. The most common cause of death was asphyxia due to inhalation of volcanic ash. The ash mixed with mucous to form occlusive plugs in upper airways. Additionally, thermal

burns were major causes of death for three of the victims, and a contributory cause for two.

There was a notable increase of emergency room visits and hospitalizations for respiratory disease: 63 were hospitalized for asthsma, 91 for bronchitis, and 32 for COPD. There were other reports of eye irritation and conjunctivitis during the first two weeks after the eruption.

The major concern about this volcano was the risk to respiratory systems, since between 94 to 99 percent of the particles were within respirable range. Also, while the ash had a high silica composition, most of it was in the form of silicates, which was not considered to have a large fibrogenic potential. There was no increase in radionuclide, leachable fluoride or other heavy metals in subsequent soil analyses.

The question of dose relationship with volcanic ash has not been resolved; however, the public health advisory of staying indoors when feasible and rescue workers using NIOSH approved masks and goggles was credited with decreasing respiratory morbidity.

<u>Snowstorms</u>

Lack of attention to warnings in the northern

tier states leads communities to ignore warnings of blizzards. In Pautucket, Rhode Island, four feet of snow fell in 24 hours, leading to massive transportation problems that the city had not foreseen. A ban on unauthorized vehicles was enforced only after 48 hours elapsed, finally allowing Army snow removal teams to clear major roadways. Both Glass, et al.(1979), and Thoret (1979) noted an increase of cardiac related deaths despite media warnings against exertion and vehicular travel.

In Massachusetts, the cause of death for 27 victims was:

Asphxia-CO intoxication	8
Heart attack/cold exposure	2
Traffic accident	1
Drowned during sea rescue	7
MI while shoveling snow	6
Lack of emergency transport	1
Miscellaneous	5

(Glass, et al., 1979: 1049)

Glass suggested that discharging medically able hospital patients to their homes before the storm could improve availability of emergency beds. Also, hospitals should

include contingency plans for the transportation of staff, and make provision for increased food and linen reserves for facilities dependent upon out-of-town deliveries. Finally, he urged earlier travel bans, more widely disseminated blizzard warnings, and telephone triaging of prospective patients to decrease unnecessary risk to EMS crews.

THE EHN AND PRE-DISASTER PLANNING

Most EHNs do not come into their new career field well equipped to deal with disasters of any type. Disaster nursing is taught as an elective in only a very few nursing schools; civilian hospital disaster plans and exercises range from very good to totally inadequate, and rarely is the staff nurse involved in the planning phase. In the Air Force, physicians, rather than nurses, are involved in the triage process; nurses, on the other hand, either "man the wards" or serve on the general "manpower" team. So, while the regulation clearly spells out the obligations of EHNs in military or civilian disasters, there is little preparation for these duties.

There are several actions EHNs can take to rectify this situation:

1. Discuss concerns and plans with the Chief of Aeromedical Services.
2. Request membership on the hospital and/or base disaster preparedness committee. On bases where the Bioenvironmental Engineer has previously been the only member of an Environmental Health Team assigned to a

base, the suggestion may be made that only the EHN or the BEE retain membership. The EHN, with the backing of the Chief of Aeromedical Services, should insist that both members serve on the committees because of the vital necessity of close cooperation between these two professionals.

3. The EHNs should endeavor to become members of the local American Red Cross Disaster preparedness team on their off-duty time, and encourage the Environmental Health technicians and other health personnel to do the same. As well as classroom instruction and simulated exercises, these teams respond to house fires, power outages, and small flash floods, as well as to more massive disasters. Working with disaster-related civilian teams will increase the EHNs practical experience as well as provide an avenue of communication to the civilian community when the need to coordinate resources arises.

The EHNs should not be surprised if the community, whether civilian or Air Force, does not show much

enthusiasm for disaster planning. As noted earlier, the military tends to view disaster relief as a peripheral function which deters them from the primary mission. Civilians, on the other hand, view themselves as being immune to natural hazards (Beyer, 1974).

Foege states that "many of the casualties and much destruction in a natural disaster are due to ignorance and neglect on the part of individual and public authorities" (1980:1,826). He reports that a CDC study of 22 U.S. disasters identified 93 instances of inappropriate management, most of which occurred because of inadequate operational disaster plans.

Rossi, et al. (1982), sampled city and state agencies whose areas had been affected by natural disasters. When these officials were asked to rank problems of public welfare, floods rated 12th (after pornography) fires 13th, hurricanes 15th, and tornadoes 16th. Even in California, earthquakes ranked only 18th. Rossi observed that, since his sample was biased toward communities with previous disaster experience, the general population would probably rate these as problems of even less consequence. Schulberg (1974) reported that:

> ...(M)any observers have been struck by the fact that residents of flood-prone areas deny or rationalize the dangers confronting them, and resignedly accept the hazardous conditions

present in their environments (p. 83).

Public officials appear to let their disbelief influence their decision making. When attempting to evaluate conflicting data, they tend to underestimate the threat. Foster (1980:192) explains that

> ...there is a well established psychological principle that, when an individual is faced with conflicting statements, he accepts as more valid that which is less threatening.

For example, when flood forecasters of the U.S. National Weather Service predicted that Hurricane Agnes had contributed to a record-breaking 40 foot crest a few hours away from Luzerne County, Pennsylvania, local officials refused to believe this was possible. They recomputed the crest height using local weather service data, and when their estimation showed 38 feet, they based their warnings on the lower figure. The crest did in fact hit 40 feet and, as a consequence of this miscalculation, the city of Wilkes-Barre remained totally unprepared for the subsequent destructive deluge (Foster, 1980).

THE EHN AND DISASTER RISK SURVEY

In order to anticipate the public health needs during a disaster, the EHNs need to assess their community on a pre-disaster basis. Those stationed in a known danger zone, e.g. the San Andreas Fault, "Tornado Alley" or the Gulf Coast, would do well to study past disasters that have affected their particular area. Those in less disaster-prone areas might want to concentrate on locating populations at risk. In any case, EHNs need to know their communities -- whether an entire state or a small town in each of these three areas: weather risks, populations at risk, and structural and geographic risks.

The map on the following page depicts major disasters in relation to Air Force base locations in the United States and corresponds with the data on Table 1, Major U.S. Natural Disasters.

More detailed weather information can be obtained from the National Oceanic and Atmospheric Administration publication, Storm Data, which details weather disturbances by state on a monthly basis. A brief review of health problems associated with various disasters will be summarized on Table 2.

Table 1

MAJOR U.S. NATURAL DISASTERS
(in order of decreasing deaths)

Type of Disaster	Place	Date	No. of Deaths
Hurricane and floods Audrey	Louisiana, Texas and several other states	June 27-28, 1957	395
Series of tornadoes	Midwest and South	April 3-4, 1974	307
Tornadoes	Midwest	April 11, 1965	272
Hurricane and subsequent floods	Mississippi, Louisiana, Virginia	August 17-20, 1969	256
Flash flood	Rapid City, S.D.	June 9, 1972	237
Series of tornadoes	Mississippi Valley States	March 21-22, 1952	229
Hurricane and floods	Northeastern United States	August 17-19, 1955	180
Tornado	Texas and Oklahoma	April 9, 1947	167
Tornado	Pennsylvania, West Virginia, Maryland	June 23, 1944	159
Flash flood	Big Thompson Canyon, Colo.	July 31, 1976	145
Series of tornadoes	Michigan and Ohio	June 8, 1953	142
Earthquake and tsunami	Alaska, California, Oregon	March 27, 1964	131
Collapse of dam made from mine wastes, flooding valley	Buffalo Creek, W. Va.	February 26, 1972	125
Tornadoes	Mississippi and Louisiana	February 21, 1971	121

35 Blank

Table 1 - Continued

Type of Disaster	Place	Date	No. of Deaths
Tornado	Oklahoma, Missouri, Arkansas	April 12, 1945	119
Hurricane and subsequent floods	Eastern Seaboard	June 19-28, 1972	118
Series of tornadoes	Kansas, Oklahoma, Texas, Missouri	May 25, 1955	115
Tornado	Waco, Texas	May 11, 1953	114
Tornadoes	Southern and Midwestern States	March 17, 1942	111
Wind and snowstorm	Northeastern United States	November 25, 1950	100
Hurricane	Atlantic Coast and New England States	October 15, 1954	100
Blizzard	Midwest	January 1978	80
Floods	Johnstown, Pennsylvania	July 1977	80
Volcano	Mt. St. Helens, Washington	May 1980	60
Blizzard	New York, Illinois, Indiana, Michigan, Ohio	July 1977	51
Severe Snowstorm	Northeast	February 1978	50
Tornado	Wichita Falls, Texas	April 1979	42

Table 1 - Continued

Type of Disaster	Place	Date	No. of Deaths
Rain, Floods, Mud-slides	Southern California	February 1980	30
Floods	Texas	August 1978	27
Flash Floods	Kansas City, Missouri	September 1977	26

(Metropolitan Life, 1982(a): 7)

Table 2

REVIEW OF DISASTER-RELATED HEALTH PROBLEMS

Type	Mortality	Morbidity	Environmental
Tornado	mobile home vehicular	multiple fractures abrasions	damaged health facilities insulative debris contam.
Flood/ Hurricane	drowning	depression hypertension	water contam. snake infestation housing destruction
Heatwave	heatstroke other CV	cardiovascular dehydration	power shortages heat fatigue in rescuers
Volcano	asphyxia burns	respiratory eye irritation	respirable volcanic ash land and water contamination
Snowstorm	MI CO asphyxia	CV problems depression	transportation disruption isolation of health facilities

Populations at Risk

In assessing their communities, the EHNs need to know where their high-risk populations reside. An examination of census data can provide basic information, but the best method of learning is to accompany the local public health nurse for a few days. Structural and socioeconomic problems can then be viewed simultaneously, allowing more complete planning.

The elderly, according to several researchers, tend to be silent victims of a disaster since low income and retired elderly are less likely to seek financial assistance than younger, more affluent persons (DHEW, 1977). However, in both Hurricane Camille and Audrey, approximately 54% of the fatalities were over 65. During the Kansas City heatwave, 72% of the fatalities were over 65 (Donnell, 1981). Allexenberg (1981) found that the profile of the person at risk for heat stroke was aged, poor, thin and chronically ill, living alone without care of friends or relatives. They were more commonly women and were 59% black. However, since the elderly often have one or more chronic diseases, it is difficult to assign risk to heat alone, especially in the case of cardio-vascular disease (Henshel, et al., 1969). However, other researchers feel that while the elderly suffer increased mortality, they seem to enjoy

decreased morbidity, possibly due to previous acculturation to hardship such as The Great Depression (Huerta and Horton, 1978).

A guidebook for planning for the elderly in a disaster suggests that agencies already serving the elderly make a roster of their clients, and personally contact them to check on their well-being. The EHNs would do well to contact such agencies to learn more about the geographical distribution of this risk group. The location of high-rise apartments, senior citizen centers, and nursing homes should be mapped. Solitary senior citizens fear displacement and numerous moves more than physical harm during a disaster (Paulshock and Cohen, 1975; DHEW, 1977).

Assessment will be needed of the number and location of the mentally and physically handicapped, whether in residential schools or homebound. Local churches are often the best resources. Also, one should note neighborhoods that are non-English speaking; needed interpreters should be part of a base disaster assistance plan.

Structural and Geographic Risks

In assessing the physical environment of the community, EHNs need to know which types of disasters are most prevalent in their area. Mobile homes are at the greatest risk in tornadoes, while homes closest to the river on the floodplain are most susceptible during heavy rains. Structures meeting strict building codes will be the safest during an earthquake; homes already isolated will experience greater problems during a blizzard. Low lying roads or underpasses in a generally dry climate will be at particular risk during flash flooding. EHNs should make sure if any of these structural or geographic risks are found on their bases, that the Bioenvironmental Engineer also assesses them so a joint report can be submitted to the base disaster preparedness committee for possible action by the Base Commander.

ORGANIZATION AND ACTION

Armed with previous knowledge, data and planning, EHNs will be prepared to quickly and efficiently respond to a given disaster. The following priorities should be observed:

1. Rapid survey of affected areas
2. Establishment of provisional notification system
3. Investigation of disease, rumored or apparent, with a temporary laboratory; compare incidence or prevalence with data from comparable non-disaster areas
4. Organize a system to report data to authorities responsible for emergency services.

During a disaster, there is often great public pressure for mass immunization campaigns; elected officials sometimes force health departments to embark on such an effort. DeVille de Goyet (1976) reasons that these campaigns drain off valuable manpower and resources which could be better used to treat trauma. Also, a natural disaster makes the logistics of a mass campaign impossible because of disruption of transportation and lack of electricity needed for refrigeration of

vaccines. He also feels that the group at risk is usually missed, and blind mass immunizations done by voluntary relief groups having neither records nor follow-up mechanisms are useless. Since typhoid fever and cholera vaccines afford a low level of short-lived individual protection, these diseases can best be prevented by prompt treatment of the water supply.

Communicable disease epidemics are likely to occur only if:

1. A new pathogen is introduced
2. Susceptibility of the population is altered (e.g. by malnutrition)
3. Transmission of pre-existing pathogen is increased.

Transmission of epidemic disease is increased by:

1. Increase in promiscuity
2. Deterioration of environmental hygiene
3. Increased chance of direct contact with pathogen, e.g. contaminated water supply
4. Interruption of established control programs, e.g. spraying for mosquitos (deVille de Goyet, 1976).

Therefore, prevention of communicable disease must be based on accurate, prompt epidemiological appraisals.

Reduction of the risk includes improvement of environmental hygiene, chemoprophylaxis, vaccination and/or treatment of cases, and isolation of infected zones.

Close cooperation with the BEE, the medical treatment facilities and security police and public information offices can increase efficiency of disease control efforts.

Behavioral problems

DeVille de Goyet (1976:97) observed that "earthquakes (or any disaster) attract individual volunteers with uncertain motives and dubious qualifications." In addition to a surplus of untrained volunteers who may tamper with precious emergency supplies, sightseers with a morbid curiosity arrive quickly to survey the damage, impeding rescue operations and contributing to rumor flow. Well-meaning outsiders, concerned for the welfare of residents of a stricken area will flood switchboards with large numbers of phone calls, telegrams and messages. Food, clothing, medicine and other supplies arrive unrequested, and worse unsorted, or in the case of drugs outdated. Dacy and Kunreuther (1969) noticed that delaying public announcement of a disaster can prevent convergence behavior from further complicating the first few disorganized hours of initial response.

Contrary to the popular belief, the morbidity problem will be complicated by persons refusing to leave their homes, not by those seeking public shelter. In an interesting comparison of evacuation behavior of victims of floods, volcanoes and Three Mile Island, the victims of the natural disaster stated they chose not to evacuate because either they did not believe the danger existed or they wanted to stay to protect their house. Those not evacuating Three Mile Island did not do so because they were not ordered to evacuate, or received too many conflicting reports.

Evacuation behavior will tend to happen this way:

1. If the people are given an evacuation warning early, then told to wait for further information, they will begin to evacuate immediately.
2. If evacuation orders are given for a specific area, surrounding areas will also evacuate.
3. If a family runs the risk of being divided, they will evacuate together (Perry, 1983:46).

The last point is important for military personnel. There is conflicting data about the behavior of

those involved in relief work. Some say that they will desert their posts to assure their family safety; others say that that is no possibility. Most mass casualty simulations do not address this fact. Safe, rapid plans for security of dependent family members will go far in alleviating personnel problems and will allow better utilization of staff.

PART II

COLLECTION AND EVALUATION OF EXPERIENCE

The most valuable function that EHNs can perform is to implement long-term research in natural disasters. This is a field that is in great need of further epidemiological research, not only for natural disasters, but to help plan for environmental and technological accidents which may become more common in the future. Melick, Logue and Frederik state:

> To our knowledge, no study to date has succeeded in presenting a comprehensive picture of physical illness in the recovery period. Such a study would need to employ a control group, make use of a longitudinal design, and most likely employ both subjective and objective means of assessing a broad range of health outcomes. Such a study would specifically need to assess severity of illness, length of illness, and treatment measures (1982:621).

The following study is proposed to begin to answer the above questions. It is planned to be carried out by EHNs stationed in the United States over a five-year period. The first two years will be data collecting of disasters, while the following three years will consist of longitudinal surveillance. The first year's disasters will be summarized and published by the fourth year, the second year's disasters in the fifth year.

A review of literature and discussion of research problems will precede the actual research plan. Examples of the assessment tools will be found in the Appendices.

REVIEW OF RESEARCH ON LONG-TERM HEALTH EFFECTS OF DISASTERS

As noted above, the research on long-term effects of natural disasters has been beset with logistic and interpretive problems. Much of the difficulty has been due to the nature of the disaster, i.e. the inability to predict the event. The suddenness of impact does not allow epidemiologists time to carefully design and carry out a study at the scene.

Previous disaster research has focused on psychiatric or social aspects of a disaster with little agreement on methods of measurement or comparability among various types of disasters. Since virtually all studies reflect retrospective data of prevalence, little reliable information is currently available concerning the differences in incidence of physical disease after a natural disaster.

Fritz (1957) postulated that communities differed in their reactions to natural disasters proportionally to the way those communities differed in their pre-disaster social and physical resources. Wright (1979) suggests that we must look at both the absolute magnitude of the damage and the resources available to the impacted

population at the time of the disaster. He conceptualizes this idea with the equation:

$$\text{Impact Ratio} = \frac{\text{Losses from natural disaster}}{\text{Total community resources}}$$

In the U.S. this may mean that disasters which occur in the rural areas may have a higher impact ratio than a city where larger populations will mitigate overall effects, and greater community resources may expedite recovery.

In attempting to look at long-term effects of natural disasters, researchers have had difficulty correlating disaster experience with subsequent illness experience because of lack of baseline, pre-disaster information for a given community. However, in assessing the Bristol floods of 1968, Bennett (1970) succeeded by comparing the health of flood and non-flood victims twelve months before and after the event. He found a strong correlation between increased clinic visits and flood experience, especially in those males whose homes were flooded by more than four feet of water. On finding that the mortality rate of flood victims increased 50%, he postulated that the flood might have been a death-hastening, rather than a death-causing event.

In 1975, Melick (1978) studied two Pennsylvania communities which suffered flooding as a result of tropical storm Agnes in 1972. She gathered data from 92 working-class, middle-aged males on four categories: demography, flood experience, life events and illness information. Surprisingly, pre-flood reports of illness exceeded post-flood reports of illness, yet 12% more of the flood victims stated that their health was worse than one year ago, and 11.6% of the flood victims perceived that the flood influenced acquisition of disease, while none of the non-flood group reported that effect. The problem in interpretation evolves from two sources: (1) that there was no baseline information of the pre-flood health status of the victims versus the controls, and (2) that the field work took place 3 years after the event. Recognizing these problems, she suggested in conclusion that a

> ...longitudinal design with periodic data collection would help to minimize errors in recalling illness episodes and would facilitate data collection on life events and symptoms experienced by the respondent.

In a complimentary study among females in the same disaster (Logue, Hansen and Struening, 1979), the research emphasis was on the physical and mental health changes over a postdisaster period spanning five years.

Using a 30 page, 105 item questionnaire, the researchers attempted to compare the health status of the flood and non-flood group. Among victims, they found increased emotional distress lasting between 18 months and two years. Long-term health status was measured by responses on a checklist of 50 specific health problems. The respondent was asked to check any health problems that either she or someone in her immediate family had developed since the onset of Hurricane Agnes. Although they were also asked to state the onset, duration, and perceived severity of the condition, many simply checked the diagnosis, and provided no further details.

Obviously there were many problems with this method. First, it assumed that all the participants knew the definitions of the medical terminology. Second, it assumed that if the name of the condition had been checked, it was indeed a correct and professionally diagnosed condition. Third, and most disturbing, it assumed that victims and non-victims had an accurate memory of events five years in the past. The bias problem of wives reporting on their husband's health, was not addressed, making one view their conclusion that male flood victims were at greater risk for cardiovascular and hypertensive episodes with great caution.

Logue and Hansen (1980) in a later study of the

same respondents performed a case-control analysis among 29 hypertensive female cases matched one-to-one according to age and ponderal index (height divided by cube root of weight). They found positive correlations between amount of property loss and hypertension among the victims. However, there are several interpretive problems:

1. The controls might have been undiagnosed hypertensives.
2. The cases might not have been hypertensive, but only believed themselves to be.
3. The cases might have been hypertensive before the flood, but not diagnosed until after the flood, thus discounting the flood experience as a contributory effect.

Again, these discrepancies arise from self-reporting conditions requiring medical sophistication and a fail--proof memory.

Most of the studies of long-term health effects make the assumption that there is indeed a positive association of life-event stress with illness. However, this assertion is far from conclusive. Most studies testing this hypothesis are cross-sectional studies of prevalence, and virtually all are conducted with volunteers (Frerich, et al., 1982; Blotchky and Titler, 1982).

It has been postulated that the need to justify illness may bias results, particularly when litigation is likely among both victims and non-victims (Struening and Rabkin, 1976; Menglesdorff, 1983; Stern, 1976). Also, illness correlation appears weak when life stress surveys are applied to disaster-torn third world countries, raising the question of cross-cultural variation in stress and illness perception (Janney, et al., 1977).

Using small numbers of matched pair cases, Janerick, et al. (1981) found that increased rates of leukemia, lymphoma and spontaneous abortion were occurring in flooded river valleys of upstate New York, when compared historically to their own previous rates, concomitantly with county and state-wide rates. After ruling out increased radiation exposure feared by the citizens, they came up with two possible causes for the time-space clustering of these cases. First, that the flooding caused people and animals escaping to higher ground to have been exposed to viruses of other humans or displaced animals. Second, the stress of those suffering the flood may have had a neuro-endocrine effect which would explain the one-year latency period between the flood and incidence of the disease. It would also explain the very slight rise in incidence in valley towns.

Obviously many more studies are needed. While stress studies are popular, the possibility of unknown environmental agents cannot be dismissed.

The solution to pertinent disaster studies seems to lie in studying interactional rather than linear effects (Logue, Melick and Struening, 1981). Although models for quantification and classification of disaster severity have been proposed (Foster, 1976; Berren, et al., 1980), these have not been used by epidemiologists, preventing cross comparison of disasters, much less their effect on health. Most studies suffer from a lack of baseline data and control groups (Logue, Melick and Struening, 1981), and almost all studies except Bennett's (1970) required recall of health and life events of up to five years in the past (Logue, Hansen and Struening, 1981; Kinston and Rosser, 1974). Melick, et al. (1981) note that no indepth study of physical effects of disasters have been published; also, longitudinal studies are needed to document incidence (Logue, Melick and Hansen, 1981).

PROPOSED SOLUTIONS TO RESEARCH PROBLEMS

Drabek (1970) summarized disaster research problems as follows:

> Conducting research in communities just struck by major disasters confronts one with some special problems. Since most disasters are unpredictable, one never knows where or when the next research opportunity will appear. Unless the research program is ongoing and long range, there usually is great haste in preparation to get into the field. Failure to begin data collection immediately may greatly reduce its validity. Funding processes are noticeably slow. Rarely are preimpact data available. Experimental manipulation through random assignment to "treatment groups" and most control procedures are inappropriate, unethical, or simply impossible. Local cooperation may be adequate at the outset. However, as more outsiders arrive with insurance, sales, welfare, and other types of inquiries, research interviewers can become increasingly suspect. For these and numerous other reasons, most disaster research has lacked much methodological sophistication. (331-332)

In his suggestion for research he strongly makes four points:

(1) Studies of immediate response can be done most effectively by ongoing field teams who are prepared to move quickly and who can collect data before it becomes overly distorted or lost.

(2) Establish rapport with local disaster-related organizations.

(3) Use pre-disaster data and a control group.

(4) Comparison of same and different event categories are needed (Drabek, 1970).

The proposed data tools below are designed to answer some of the logistical and methodological problems involved in disaster research of long-term health problems. By the nature of the Air Force readiness mission, the EHN along with the Bioenvironmental Engineer have the opportunity to be prepared to move into a disaster area when called. To establish rapport with the civilian community it is suggested that they take part in civilian rehearsals, and become members of the American Red Cross Disaster Response Teams on their off-duty time. When community agencies already know them, it will be easier to integrate during the hectic times immediately post-disaster, and they will be likely to get more information from agencies and community involved.

The use of a control group must be part of a reliable research design. However, the EHNs have the opportunity, due to their preparation in demography and epidemiology, to obtain baseline health-status data upon assignment at their next duty station. Communications

with local health departments and exchanges of information on an informal basis can be more valuable than all the committee meetings combined. Knowledge of environmental as well as potential natural disaster hazards, number of mobile homes, etc. can allow them to have baseline data in place so that early comparisons can be made that will benefit both planning and intervention protocols.

Comparison of catastrophic events of differing types has continued to be a problem. However, two tools can conceptualize a disaster both qualitatively and quantitively providing a basis of comparison. The first method, a qualitative approach has been proposed by Berren, Beigel and Ghertner (1980, p. 105). Five dimensions of a disaster are described (See Appendix IVA).

(1) Type of disaster: whether it is natural (Act of God) or man-made. As discussed previously, man-made disasters seem to have more impact because they are perceived as preventable. A certain fatalism accompanies natural disasters which appears to help many people go forward rather than dwell upon what might have been prevented.

(2) Duration of the event: Short duration events are usually perceived as less traumatic than long-duration events. Of course, duration is relative to the sufferers. In the 1976 Chowchilla, California kidnapping, the busdriver and school-children were buried for a total of 36 hours before escaping. That many hours of fearing certain death is conceptually perceived long duration.

(3) Degree of personal impact: The collapse of the aerial walkways at a Kansas City, Missouri hotel in 1981 had high personal impact, as many rescuers knew the victims and became involved in discovering bodies of loved ones. In the 1978 Tucson, Arizona Air Force jet crash, the disaster had a high personal impact on the family and friends of the pilots involved, but for the junior high school children who saw the crash, it had relatively little personal impact.

(4) Potential for recurrence: An event that has a high potential for recurrence is considerably more stressful than one that is

deemed to have no chance of happening again. Living in a mobile home in "Tornado Alley" has a high potential for happening again. The Tucson air crash has a low potential.

(5) Control over future impact: High control would be more desirable than low control--this is where natural disasters are more stressful than man-made disasters. The Tucson air crash led citizens to petition the Air Force Base to change its flight pattern; the Chowchilla kidnapping led parents to either change schools or drive their children themselves. The Wichita Falls Tornado or the Times Beach Flood would have low control over the future in the aspect of preventing its happening, but could have health effects mitigated by earlier warnings, change of residence, etc.

A method of quantifying a disaster is proposed by Foster (1976). Using Holmes and Rahe's Social Readjustment Rating Scale as a guide, he has developed two formulas--one for the developing world with its larger average family size, and one for the developed world which will be examined below.

For this method, Foster has made the following assumptions:

(1) The stress associated with the victim's death or injury is at least equal to the stress assigned to the surviving or uninjured spouse, i.e. death = 100; injury = 53.

(2) Approximately 45% of the population is married so that spouse stress would be 45 for death and 20 (rounded off) for injury.

(3) The average family size is considered to be approximately 4.5, leaving three others excluding the spouse to be impacted by the death (63 x 3 = 189) or injury (44 x 3 = 132).

(4) The number of close friends impacted by an individual's disaster experience is three: (death = 37 x 3 = 111; injury = 25 x 3 = 75).

Therefore, the death of one individual in the developed world is considered to generate 445 stress units (100 + 45 + 189 + 111). Likewise the injury of each individual in the developed world is considered to generate 280 stress points (53 + 20 + 132 + 75).

His formula is:

$$TS_{DD} = 445a + 280b + cd$$

Where:

TS_{DD} = total stress score for disaster in developed country

445 = total stress score for each death

a = number of fatalities

280 = total stress score for each injury

b = number of seriously injured

c = infrastructural stress value (Appendix IVB)

d = total population affected

The major advantage of Foster's formula is its flexibility in quantifying small or large disasters regardless of type and its sensitivity to social as well as physical impact. His calamity magnitude scale allows rapid comparison of a series of disasters and can provide many researchers with an easy and uniform basis to analyze severity/result relationships. It is proposed that Air Force Environmental Health Nurses use this formula to quantify the disaster as soon as the casualty statistics are confirmed.

THE STUDY OBJECTIVES

The following research proposal is designed to examine and compare illness incidence after a natural disaster in the United States between a victim and a control group. The tools would be prepared in advance to allow the EHN to begin immediate assessment. They are designed to answer the following questions:

1(a) Is there a demographic difference between the victim and the control group?

1(b) What is the estimate of demographic difference between respondents and non-respondents when compared to the demographic characteristics of affected census tracts?

2(a) Is there any difference between the total symptom incidence of a disaster group compared to the control group and what, if any, is the time frame when the greatest difference occurs?

2(b) What, if any, are the differences in the symptom index between the victim and control group when stratified by symptom

categories?

2(c) Do these differences remain when the two groups are stratified by sex, age, marital status, ethnic group, religion, education or income?

3(a) Within the disaster group, does the amount of disaster experience correlate with the amount of reported symptom incidence and severity?

3(b) Within the disaster group, does the amount of disaster experience correlate with any of the categories of symptoms?

3(c) Within the disaster group, does there appear to be a demographically-determined population at risk for high, medium or low disaster experience?

4(a) For between-disaster event comparisons, do certain types of disasters demonstrate increased incidence or severity of symptoms or types of symptoms?

4(b) When the disaster magnitude is quantified, is there any correlation with symptom incidence or severity?

DATA GATHERING TOOLS

For each of the four questions, a set of tools has been devised (Appendices I through IV). The first three will be magnetically marked on a sensitized sheet to allow for rapid computer analysis at the base level.

<u>Question one - Demographic Information</u> (Appendix I)

This questionnaire will allow comparisons between victim and control groups, and allow tentative descriptions of a population at risk. Also, the sample demographic determinants can be compared to the impacted and spared census tracts for a given community to allow a summation of the representativeness of the sample of volunteers.

<u>Question two - Health Questionnaire</u> (Appendix II)

The chosen list of symptoms was adopted from Jones, <u>et al</u>. (1980). The scale was used to quantify severity was adapted from Parkinson, <u>et al</u>. (1980), and will be valuable in assessing changes over time, possibly allowing researchers to hypothesize the post-disaster time frame which demonstrates the greatest

risk. The questionnaire is to be scored as follows:

NONE = 0.0

VERY LITTLE = 0.25

SOME = 0.50

A LOT = 0.75

ALL THE TIME = 1.00

The total for all items will be divided by 45 for males and 50 for females giving a symptom index score.

Additionally, each item is correlated to a symptom category to allow analysis of the different types of symptom incidence (Appendix IIA).

<u>Question three - Disaster Experience Questionnaire</u> (Appendix III)

Various aspects of disaster loss can be examined with the following questionnaire classifications:

(1) Previous disaster experience (Meliti, Drabek and Haas, 1975)
Item #1

(2) Known chemical exposure (Melick, Logue and Frederick, 1982)
Item #2

(3) Physical injury (Logue, Hansen and Struening, 1979)
Items #5, #6

(4) Social impact (Kinston and Rosser, 1974)
Items #2, #3, #7, #8, #9, #10

(5) Property loss (Bennett, 1968)
Items #11, #12, #13, #14, #15, #16

(6) Evacuation status (Logue, Hansen and Struening, 1981)
Items #17, #18, #19, #20

The questions will be scored:

YES = 1.00 NO = 0.0

SPOUSE = 1.00; FAMILY = 0.75; FRIEND = 0.50; ACQUAINTANCE = 0.25

ALL = 1.00; MOST = 0.75; SOME = 0.50; NONE = 0.0

1 WEEK OR MORE = 1.00; FEW DAYS = 0.75; ONE DAY = 0.50; FEW HOURS = 0.25

The score for each item will be totaled and categorized:

High score:	21 to 11 points
Medium score:	10 to 6 points
Low score:	5 to 0 points

Question four (a) - Disaster Classification (Appendix IVA)

Using the typology model from Berren, Beigel and Ghertner, a disaster can be classified by the following dimensions:

1. Type of disaster (natural versus man-made)
2. Duration (short versus long)
3. Degree of personal impact (high versus low)
4. Potential for recurrence (high versus low)
5. Control over future impact (high versus low)

<u>Question four (b)</u> - <u>Disaster Quantification</u> (Appendices IVB & IVC)

To assess the calamity magnitude for the developed world, Foster's (1976) formula can be utilized.

$$TS_{DD} = 445a + 280b + cd \text{ (p. 244)}$$

Note: If an EHN is called upon to assist in a disaster in the developing world, the following equation is appropriate:

$$TS_{DG} = 630a + 410b + cd \text{ (p. 244)}$$

Definition of terms:

TS_{DD} = total stress score for disaster in developed country

a = number of fatalities

b = number of seriously injured

c = infrastructural stress value (Appendix IVB)

d = total population affected (Foster, 1976: 245)

TS_{DG} = total stress score for disaster in developing country

Finally, the logarithmic total can be placed on the Calamity Magnitude Scale (Appendix IVC).

PROPOSED METHOD OF CONDUCTING RESEARCH

1. At the disaster scene:
   - (a) Classify the disaster using Appendix IVA.
   - (b) Quantify the disaster using Foster's formula and place on log scale (Appendix IVC)
   - (c) Map out area affected by census tract; if not already done, gather demographic data on affected and non-affected tracts.
2. Choosing participants for study:
   - (a) Obtain list of victims either from American Red Cross Disaster Director or from the Federal Emergency Management Agency.
   - (b) Select every fourth name (using a random start and assuming a large affected population). If the victim lists contain fewer than 100 family names, attempt to contact all victims.
   - (c) Select (randomly) double the number of controls from the telephone directory, discarding those already chosen from the victim list. With this method obviously some victims who were not on any agency list will be obtained. However, this will decrease some of the information bias

due to the consultative rather than outreach function by which most agencies operate.

(d) Compile the two lists; code the questionnaires.

3. Distributing the Questionnaires

(a) Within three days send or deliver cover letter (Appendix V).

(b) Within one week send two sets of questionnaires per household. Try to time arrival towards the end of the week.

(c) Be available for telephone consultation and home visits to help those requesting assistance.

(d) By the end of week two, send Thank You postcards to all participants.

(e) Do a telephone follow-up and replacement mailing of questionnaires (week three).

(Miller, 1977; Orlich, 1978)

4. Follow-up Health Questionnaire:

(a) Prepare a new list of all respondents at the end of six weeks.

(b) Send symptom survey tool at the 2 month, 6 month, 1 year, 2 year and 3 year intervals.

5. Analyze data at each time interval, and examine for differences or trends.

6. Compare results with other disasters researched by other EHNs using the disaster classification and quantification tools as in Step 1(a) above.

A small disaster (e.g. fewer than 100 affected families) could be investigated by a single EHN; however, at least two EHNs will be needed for initial data-gathering for a large disaster. Continued written and telephone consultation throughout the study period would be advised. (See Appendix VI.)

DATA ANALYSIS

FOR DEMOGRAPHY:

1(a) Compare the number and percentages for disaster and control groups according to the demographic categories on the questionnaire.

1(b) Compare the number and percentages for the disaster group by demographic determinants with the data for the census tracts affected by the disaster. Do the same for the control group and the census tracts which were unaffected by the disaster. Summarize how they differ demographically.

Note: If a whole community has been affected (e.g., Times Beach, Missouri), the closest comparable community should be used as a control group and similarly analyzed. Be aware, however, that there may be unmeasurable variables which might explain the differences in illness experience.

Table 3

SUMMARY OF DEMOGRAPHIC CHARACTERISTICS OF SAMPLE VICTIMS AND VICTIM CENSUS TRACTS

	VICTIMS			
	N	% of sample	N	% census
Sex:				
Male				
Female				
No answer				
Age:				
19 or under				
20 to 39				
40 to 59				
60 or older				
No answer				
Marital Status:				
Single				
Divorced				
Separated				
Widowed				
Married				
Ethnicity:				
Black				
Oriental				
Hispanic				
American Indian				
Caucasian				
Other				
No answer				
Religion:				
Catholic				
Jewish				
Protestant				
Other				
None				

SUMMARY OF DEMOGRAPHIC CHARACTERISTICS OF SAMPLE
VICTIMS AND VICTIM CENSUS TRACTS Table 3 - Continued

	VICTIMS			
	N	% of sample	N	% census
Education:				
Some grammar				
Some high				
High school grad				
Some college				
Bachelors				
Masters or above				
No answer				
Income:				
$ 0 - 4,999				
$ 5 - 9,999				
$10 - 19,999				
$20 - 29,999				
$30 - 49,999				
$50 and above				
No answer				
Income Contribution:				
Housework				
Less than ½				
More than ½				
All				
No answer				

Table 4

SUMMARY OF DEMOGRAPHIC CHARACTERISTICS OF SAMPLE

CONTROLS AND NON-VICTIM CENSUS TRACTS

	CONTROLS			
	N	% of sample	N	% census
Sex:				
Male				
Female				
No answer				
Age:				
19 or under				
20 to 39				
40 to 59				
60 or older				
No answer				
Marital Status:				
Single				
Divorced				
Separated				
Widowed				
Married				
Ethnicity:				
Black				
Oriental				
Hispanic				
American Indian				
Caucasian				
Other				
No answer				
Religion:				
Catholic				
Jewish				
Protestant				
Other				
None				

SUMMARY OF DEMOGRAPHIC CHARACTERISTICS OF SAMPLE
CONTROLS AND NON-VICTIM CENSUS TRACTS Table 4 - Continued

CONTROLS

	N	% of sample	N	% census
Education:				
Some grammar				
Some high				
High school grad				
Some college				
Bachelors				
Masters or above				
No answer				
Income:				
$ 0 - 4,999				
$ 5 - 9,999				
$10 - 19,999				
$20 - 29,999				
$30 - 49,999				
$50 and above				
No answer				
Income Contribution:				
Housework				
Less than ½				
More than ½				
All				
No answer				

DATA ANALYSIS

FOR SYMPTOM INCIDENCE:

2(a) Compute and compare the median, mean and standard deviation for the total symptom index score for the disaster and the control group at the time of the disaster, and at the 2 month, six month, one, two and three year intervals.

2(b) Compute and compare the median, mean and standard deviation of the categorical symptom index, i.e. muscular-skeletal, neurological, etc., for the disaster and the control group at the time of the disaster, and at the 2 month, six month, one, two and three year intervals.

2(c) Stratify the means of the total symptom index by demographic parameters at each time interval.

Table 5

SUMMARY OF TOTAL SYMPTOM INDEX SCORE

FOR DISASTER GROUP

	DISASTER GROUP					
				Years		
	Dis	2 mo	6 mo	1	2	3
Number of Respondents						
Median						
Mean						
SD						

Table 6

SUMMARY OF TOTAL SYMPTOM INDEX SCORE

FOR CONTROL GROUP

	CONTROL GROUP					
					Years	
	Dis	2 mo	6 mo	1	2	3
Number of Respondents						
Median						
Mean						
SD						

Table 7

SUMMARY OF CATEGORICAL SYMPTOM

INDEX FOR DISASTER GROUP

	DISASTER GROUP											
							Years					
	Dis		2 mo		6 mo		1		2		3	
Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Muscular-Skeletal												
Median												
Mean												
Standard Deviation												
Neurological												
Median												
Mean												
Standard Deviation												
Respiratory												
Median												
Mean												
Standard Deviation												
Cardiovascular												
Median												
Mean												
Standard Deviation												
Gastrointestinal												
Median												
Mean												
Standard Deviation												
Psychological												
Median												
Mean												
Standard Deviation												
Endocrine												
Median												
Mean												
Standard Deviation												

SUMMARY OF CATEGORICAL SYMPTOM
INDEX FOR DISASTER GROUP Table 7 - Continued

	DISASTER GROUP											
	Dis		2 mo		6 mo		Years 1		2		3	
Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Hypertension												
Median												
Mean												
Standard Deviation												
Dermatological												
Median												
Mean												
Standard Deviation												
Gynecological												
Median												
Mean												
Standard Deviation												

Table 8

SUMMARY OF CATEGORICAL SYMPTOM

INDEX FOR CONTROL GROUP

	CONTROL GROUP											
							Years					
	Dis		2 mo		6 mo		1		2		3	
Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Muscular-Skeletal												
Median												
Mean												
Standard Deviation												
Neurological												
Median												
Mean												
Standard Deviation												
Respiratory												
Median												
Mean												
Standard Deviation												
Cardiovascular												
Median												
Mean												
Standard Deviation												
Gastrointestinal												
Median												
Mean												
Standard Deviation												
Psychological												
Median												
Mean												
Standard Deviation												
Endocrine												
Median												
Mean												
Standard Deviation												

SUMMARY OF CATEGORICAL SYMPTOM
INDEX FOR CONTROL GROUP Table 8 - Continued

	CONTROL GROUP											
							Years					
	Dis		2 mo		6 mo		1		2		3	
Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Hypertension												
Median												
Mean												
Standard Deviation												
Dermatological												
Median												
Mean												
Standard Deviation												
Gynecological												
Median												
Mean												
Standard Deviation												

Table 9

SUMMARY OF TOTAL SYMPTOM INDEX SCORE OF

VICTIMS BY DEMOGRAPHIC CHARACTERICS

Category	Disaster											
							Years					
	Dis		2 mo		6 mo		1		2		3	
Total Number of Respondents:	N	%	N	%	N	%	N	%	N	%	N	%
Sex:												
Male												
Female												
No answer												
Age:												
19 or under												
20 to 39												
40 to 59												
60 or older												
No answer												
Marital Status:												
Single												
Divorced												
Separated												
Widowed												
Married												
Ethnicity:												
Black												
Oriental												
Hispanic												
American Indian												
Caucasian												
Other												
No answer												
Religion:												
Catholic												
Jewish												
Protestant												
Other												
None												

SUMMARY OF TOTAL SYMPTOM INDEX SCORE OF
VICTIMS BY DEMOGRAPHIC CHARACTERICS Table 9 -Continued

Category	Disaster											
							Years					
	Dis		2 mo		6 mo		1		2		3	
Total Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Education:												
Some grammar												
Some high												
High school grad												
Some college												
Bachelors												
Masters or above												
No answer												
Income:												
$ 0 - 4,999												
$ 5 - 9,999												
$10 - 19,999												
$20 - 29,999												
$30 - 49,999												
$50 and above												
No answer												
Income Contribution:												
Housework												
Less than ½												
More than ½												
All												
No answer												

AD-A135 366 THE ROLE OF THE AIR FORCE ENVIRONMENTAL HEALTH NURSE IN LONG-TERM HEALTH..(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH B T KAUFFMAN JUN 83 2/2

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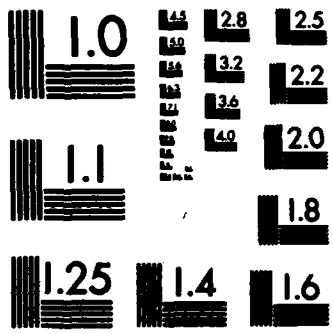

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 10

SUMMARY OF TOTAL SYMPTOM INDEX SCORE OF

CONTROLS BY DEMOGRAPHIC CHARACTERISTICS

Category	Control											
							Years					
	Dis		2 mo		6 mo		1		2		3	
Total Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Sex:												
Male												
Female												
No answer												
Age:												
19 or under												
20 to 39												
40 to 59												
60 or older												
No answer												
Marital Status:												
Single												
Divorced												
Separated												
Widowed												
Married												
Ethnicity:												
Black												
Oriental												
Hispanic												
American Indian												
Caucasian												
Other												
No answer												
Religion:												
Catholic												
Jewish												
Protestant												
Other												
None												

DATA ANALYSIS

FOR DISASTER EXPERIENCE:

Definitions:	High disaster score:	21 to 11
	Medium disaster score:	10 to 6
	Low disaster score:	5 to 0

3(a) Using demographic parameters, calculate the percentages of those experiencing high, medium and low disaster scores.

3(b) For high, medium and low disaster groups, compare median, mean and standard deviation.

3(c) Compare percentages for the following groups at each time interval:
High disaster/high symptom scores
High disaster/low symptom scores
Low disaster/high symptom scores
Low disaster/low symptom scores

SUMMARY OF TOTAL SYMPTOM INDEX SCORE OF CONTROLS BY DEMOGRAPHIC CHARACTERISTICS Table 10 - Cont.

Category	Control											
	Dis		2 mo		6 mo		Years 1		2		3	
Total Number of Respondents	N	%	N	%	N	%	N	%	N	%	N	%
Education:												
Some grammar												
Some high												
High school grad												
Some college												
Bachelors												
Masters or above												
No answer												
Income:												
$0 - 4,999												
$5 - 9,999												
$10 - 19,999												
$20 - 29,999												
$30 - 49,999												
$50 and above												
No answer												
Income Contribution:												
Housework												
Less than ½												
More than ½												
All												
No answer												

Table 11

DATA ANALYSIS FOR DEMOGRAPHIC/

DISASTER EXPERIENCE

	High Disaster		Medium Disaster		Low Disaster	
Total N =	N	%	N	%	N	%
Sex:						
Male						
Female						
No answer						
Age:						
19 or under						
20 to 39						
40 to 59						
60 or older						
No answer						
Marital Status:						
Single						
Divorced						
Separated						
Widowed						
Married						
Ethnicity:						
Black						
Oriental						
Hispanic						
American Indian						
Caucasian						
Other						
No answer						
Religion:						
Catholic						
Jewish						
Protestant						
Other						
None						

DATA ANALYSIS FOR DEMOGRAPHIC/DISASTER EXPERIENCE Table 11

	High Disaster		Medium Disaster		Low Disaster	
Total N =	N	%	N	%	N	%
Education:						
Some grammar						
Some high						
High school grad						
Some college						
Bachelors						
Masters or above						
No answer						
Income:						
$ 0 - 4,999						
$ 5 - 9,999						
$10 - 19,999						
$20 - 29,999						
$30 - 49,999						
$50 and above						
No answer						
Income Contribution:						
Housework						
Less than ½						
More than ½						
All						
No answer						

Table 12

SUMMARY OF DATA ANALYSIS FOR DISASTER

EXPERIENCE AND SYMPTOM CATEGORY

	High Disaster	Medium Disaster	Low Disaster
	N = ___	N = ___	N = ___
Number of Respondents			
Muscular-Skeletal			
Median			
Mean			
Standard Deviation			
Neurological			
Median			
Mean			
Standard Deviation			
Respiratory			
Median			
Mean			
Standard Deviation			
Cardiovascular			
Median			
Mean			
Standard Deviation			
Gastrointestinal			
Median			
Mean			
Standard Deviation			
Psychological			
Median			
Mean			
Standard Deviation			
Endocrine			
Median			
Mean			
Standard Deviation			

SUMMARY OF DATA ANALYSIS FOR DISASTER EXPERIENCE AND SYMPTOM CATEGORY Table 12 - Continued

	High Disaster	Medium Disaster	Low Disaster
	N = ___	N = ___	N = ___
Hypertension			
Median			
Mean			
Standard Deviation			
Dermatological			
Median			
Mean			
Standard Deviation			
Gynecological			
Median			
Mean			
Standard Deviation			

Table 13

SUMMARY OF PERCENTAGES OF HIGH/LOW DISASTER GROUPS WITH HIGH/LOW DISASTER SCORES

Group	Disaster	2 mo	6 mo	1 yr	2 yr	3 yr
Total Sample N: ————						
High disaster/high symptom						
Number						
Percentage						
Median disaster score						
Mean disaster score						
Median symptom score						
Mean symptom score						
High disaster/low symptom:						
Number						
Percentage						
Median disaster score						
Mean disaster score						
Median symptom score						
Mean symptom score						
Low disaster/high symptom						
Number						
Percentage						
Median disaster score						
Mean disaster score						
Median symptom score						
Mean symptom score						
Low disaster/low symptom:						
Number						
Percentage						
Median disaster score						
Mean disaster score						
Median symptom score						
Mean symptom score						

DATA ANALYSIS

FOR DISASTER CLASSIFICATION:

4(a) Classify each disaster on Berren, Beigel and Ghertner's Typology Grid; compare similar disasters with their mean symptom index score (Appendix IVA).

4(b) Quantify each disaster using Foster's formula; after placing on log scale, compare similar grouped disasters and their mean symptom index scores (Appendices IVB and IVC).

POTENTIAL METHOD PROBLEMS AND INFORMATION BIAS

Use of Questionnaire

Even with intensive follow-up, the best response rate on a questionnaire survey can be expected to be only about 50% (Miller, 1977). Logue, Hansen and Struening (1981) found that their control group had only 21% return rate. While at 30 pages and 105 questions, their forms were longer than those proposed here, it still is likely that lack of interest will give approximately the same result.

To increase response, a great effort has been made to address brevity and ease of completion. Although 15 minutes completion time is suggested in the permission letter, all tools were informally timed by adults and children with an average 5 minutes completion time. To increase visual appeal, the forms will be professionally printed and presented in booklet form.

Saarinen (1974) feels that use of a questionnaire causes a researcher's dilemma. While open-ended questions may give more information, they also are most easily misunderstood, and are often altered by the researchers to suit their circumstances. He suggests:

> It is probably better for the time being, at least, to seek the broad though rough comparisons. There is a dilemma here, for the most interesting questions are often indirect and open to misunderstanding. While a wide range of information is obtainable through simple short-answer questions they have the disadvantage of depending entirely on the researcher's ideas and provide no means of tapping the cognitive world of the respondent on his own terms (p. 184).

Use of Volunteers

Volunteers will bias the results in favor of those who are:

1. Interested in disaster problems
2. Better educated
3. Interested in their health status

The bias will probably be weighted toward those with high symptom and/or high disaster experience. Therefore, the nature of this study will provide data applicable only to volunteers in a similar community experiencing a similar disaster. However, it is hoped that enough data will be systematically accumulated that hypotheses can be formulated and tested by Air Force or other researchers.

Anti-military Bias

As discussed earlier, many citizens have ambivalent feelings toward military. In an era of discussion

on the nuclear freeze issue, there may be some who will refuse to participate in the survey because of strong anti-war/anti-military convictions. If this trend continues, the Air Force might consider researching jointly with the University of Ohio or University of Colorado Disaster Research Centers, and allow them to be the sponsoring agencies. Additionally, cooperation on resources, particularly computer time, may work to mutual advantage.

Test Validity

These tools have not yet been tested for internal validity. A test-retest correlation could be run, perhaps as part of an Air Force mass casualty exercise. While an attempt could be made to assess specificity of the health questionnaire using Air Force Medical Records, the results may be inconclusive. Medical records do not generally reflect subtle symptom changes as designed by this survey.

Another method of testing could be a six-month, six base trial, where the first six bases to experience a natural disaster would be approved to make a 25 person survey. After review and revision, the EHNs at all bases could be authorized to start the five-year study.

APPLICATION OF EXPERIENCE

The reason we advocate Public Health is to prevent disease; the reason we research disasters is to learn how to intervene at the right time, at the right place, and with the right people. Disaster research, however, suffers ebbs and tides of popularity. As Glanz wryly observed:

> ...yet for one reason or another -- political expediency, lack of resources, lack of concern, the will of governments to cope...surfaces only intermittantly. Their will is strong when a crisis is new, but fades as the crisis continues in time, especially when it becomes clear that solutions required to deal effectively with the problems are often difficult to impliment, and are not without sacrifice on the part of the recipient and donor... (1976:20).

Glass, et al. (1980) have helped to refine tornado intervention procedures with their comprehensive analysis of morbidity and mortality. Berren, Beigel and Barker (1982) have refined their typology into a methodology to respond to various mental health problems related to disaster effects. EHNs have the capability to contribute both to research studies and to intervention guidelines by utilizing their MPH training in epidemiological methods and the mobility afforded by their being Air Force

officers. The Environmental Health Teams have the potential to become leaders in the field of disaster research and intervention, both in the United States and throughout the world.

FINAL RECOMMENDATIONS

To increase EHNs proficiency in the field of disaster research and response, the following recommendations are proposed:

1. Collection of historical data on Air Force interventions in natural disasters, both here and abroad.
2. Annual TDY to either the University of Colorado or the University of Ohio Disaster Centers for continuing education. Those stationed in Europe might attend the University of Louvain, Brussels, Belgium.
3. Publication of findings in Public Health Reports, and Aviation, Space and Environmental Medicine, as well as other appropriate journals.
4. Encourage EHNs to join their base's Speaker's Bureau, and inform the Public Affairs Office of their expertise in the field.
5. Publish a comprehensive study on application of the lessons of natural disasters to nuclear, biological and chemical warfare

situations.

6. Secure continued funding and support from military, community and health agencies to advance epidemiological studies in the field of disaster research.

EHNs have much to offer both the civilian and military communities. It is the author's hope that these professionals will be utilized to the fullest extent possible.

APPENDIX

APPENDIX I

Question one - Demographic Information

QUESTIONNAIRE

For household members ID#_______________
18 years of age and older.

Please check only one item for each question. All responses are voluntary and will remain confidential.

1. Your sex is _____Male _____Female

2. Your age is: _____19 or under
   _____20 to 39
   _____40 to 59
   _____60 or older

3. Your marital status is: _____Single
   _____Divorced
   _____Separated
   _____Widowed
   _____Married

4. Your ethnic background is:
   _____Black or Afro-American
   _____Oriental or Asian
   _____Hispanic
   _____American Indian
   _____White or Caucasian
   _____Other (please specify)___________

5. Your religious preference is:
   _____Catholic _____Jewish
   _____Protestant _____None
   _____Other (please specify)___________

APPENDIX I - continued

6. Your highest educational level is:

   _____Some grammar school
   _____Some high school
   _____High school graduate
   _____Some college
   _____Bachelors Degree
   _____Masters Degree or above

7. Your total family annual income level is:

   _____$ 0 - 4,999
   _____$ 5 - 9,999
   _____$10 - 19,999
   _____$20 - 29,999
   _____$30 - 49,999
   _____$50,000 and above

8. You personally contribute to the annual family income by:

   _____Full time housework, no outside employment
   _____Earning and/or contributing less than ½ of total
   _____Earning and/or contributing more than ½ of total
   _____Earning and/or contributing all of total

APPENDIX II

Question two - Health Questionnaire

QUESTIONNAIRE

Here are a number of questions about your health and feelings. Please read each question carefully, and give your best answer. There are no right or wrong answers. We are simply interested in YOUR feelings about your health. If you have any questions, please call us at____.

****

During the past month, have you had much trouble with:

	NONE	VERY LITTLE	SOME	A LOT	ALL THE TIME
1. Arthritis	___	___	___	___	___
2. Asthma	___	___	___	___	___
3. Blurred vision	___	___	___	___	___
4. Constant thirst	___	___	___	___	___
5. Constipation	___	___	___	___	___
6. Convulsions	___	___	___	___	___
7. Cough	___	___	___	___	___
8. Depression/ sadness	___	___	___	___	___
9. Diarrhea	___	___	___	___	___
10. Diabetes	___	___	___	___	___
11. Dizziness	___	___	___	___	___

APPENDIX II - continued

	NONE	VERY LITTLE	SOME	A LOT	ALL THE TIME
12. Drinking alcohol	___	___	___	___	___
13. Fainting	___	___	___	___	___
14. Forgetfulness	___	___	___	___	___
15. Frequent urination	___	___	___	___	___
16. Hay fever	___	___	___	___	___
17. Headaches	___	___	___	___	___
18. Heart skipping beats	___	___	___	___	___
19. High blood pressure	___	___	___	___	___
20. Irritability	___	___	___	___	___
21. Loss of appetite	___	___	___	___	___
22. Loss of weight	___	___	___	___	___
23. Nausea	___	___	___	___	___
24. Nervousness	___	___	___	___	___
25. Numbness	___	___	___	___	___
26. Pain in back	___	___	___	___	___
27. Pain in chest	___	___	___	___	___
28. Pain in legs	___	___	___	___	___
29. Pain in stomach	___	___	___	___	___
30. Paralysis of limbs	___	___	___	___	___
31. Ringing in ears	___	___	___	___	___

APPENDIX II - continued

	NONE	VERY LITTLE	SOME	A LOT	ALL THE TIME
32. Seeing colored halos	___	___	___	___	___
33. Shortness of breath	___	___	___	___	___
34. Skin infections	___	___	___	___	___
35. Skin rashes	___	___	___	___	___
36. Smoking cigarettes	___	___	___	___	___
37. Sore throat	___	___	___	___	___
38. Stuffy nose	___	___	___	___	___
39. Swelling in hands and feet	___	___	___	___	___
40. Stiff neck	___	___	___	___	___
41. Tiredness	___	___	___	___	___
42. Trouble sleeping	___	___	___	___	___
43. Vomiting	___	___	___	___	___
44. Weakness	___	___	___	___	___
45. Wheezing	___	___	___	___	___

****

FOR FEMALES ONLY:

46. Unusually heavy menstral flow	___	___	___	___	___
47. Irregular periods	___	___	___	___	___
48. Unexplained skipped periods	___	___	___	___	___

APPENDIX II - continued

	NONE	VERY LITTLE	SOME	A LOT	ALL THE TIME
49. Trouble getting pregnant	___	___	___	___	___
50. Miscarriage	___	___	___	___	___

APPENDIX IIA

KEY TO SYMPTOM CATEGORIES

Muscular-Skeletal	1,26,28,40.
Neurological	6,11,13,17,25,30,31,44.
Respiratory	2,7,16,37,38,45.
Cardiovascular	18,27,33,39.
Gastrointestinal	5,9,23,29,43.
Psychological	8,12,14,20,21,24,36,41,42.
Endocrine	4,10,15,22.
Hypertension	3,19,32.
Dermatological	34,35.
Gynecological	46,47,48,49,50.

APPENDIX III

Question three - Disaster Experience Questionnaire

Please circle the appropriate answer:

1.	Have you ever been in a disaster before this one?	YES	NO
2.	Were you exposed to a dangerous chemical during this disaster?	YES	NO
3.	Did anyone you know die as a result of this disaster?	YES	NO
4.	Who were they? (SPOUSE, FAMILY, FRIEND, ACQUAINTANCE)		
5.	Did the disaster result in physical injury to you?	YES	NO
6.	Did you seek medical care for the injury?	YES	NO
7.	Did the disaster result in physical injury to any close family members?	YES	NO
8.	Did they seek medical care?	YES	NO
9.	Were any of your friends injured?	YES	NO
10.	About how many? (ALL MOST SOME NONE)		
11.	Did you lose any property?	YES	NO
12.	Did you lose your home?	YES	NO
13.	Did you lose your job?	YES	NO
14.	Did you lose your business?	YES	NO

APPENDIX III - continued

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15. About how much property did you lose?
(ALL   MOST   SOME   NONE)

16. About how much property will you be able to recover or replace?
(ALL   MOST   SOME   NONE)

17. Did you have to evacuate your home or business to stay with family, friends or neighbors?   YES   NO

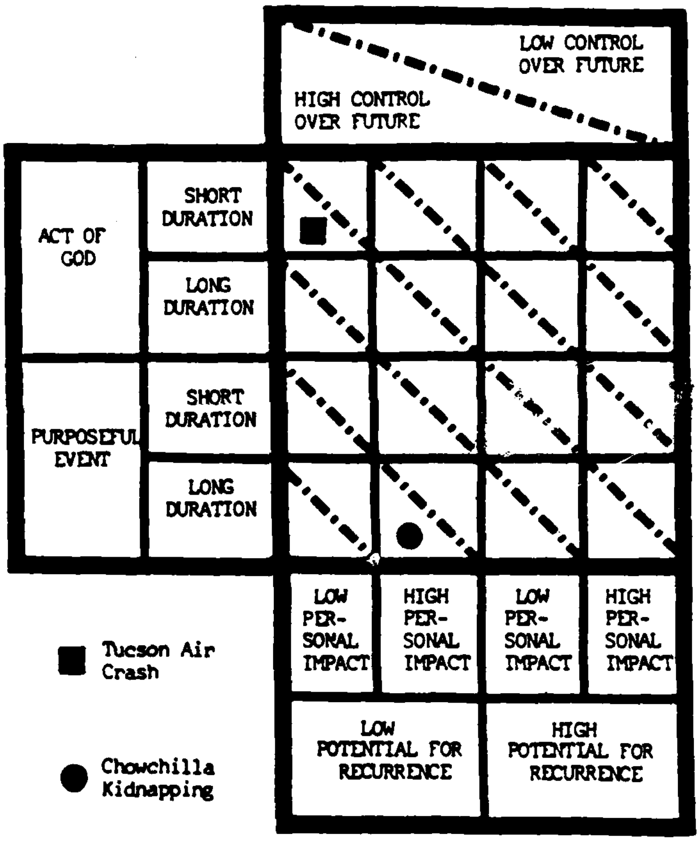
18. For how long?
(1 WEEK OR MORE, FEW DAYS, ONE DAY, FEW HOURS)

19. Did you have to evacuate your home or business to stay in a public shelter?   YES   NO

20. For how long?
(1 WEEK OR MORE, FEW DAYS, ONE DAY, FEW HOURS)

APPENDIX IVA

DISASTER CLASSIFICATION TYPOLOGY



(Berren, Beigel, and Ghertner 1980:105)

APPENDIX IVB

INFRASTRUCTURAL STRESS VALUES

Event Intensity	Designation	Characteristics	Stressor Value
I	Very minor	Instrumental	0
II	Minor	Noticed only by sensitive people	2
III	Significant	Noticed by most people including those indoors	5
IV	Moderate	Everyone fully aware of event. Some inconvenience experienced, including transportation delays.	10
V	Rather Pronounced	Widespread sorrow. Everyone greatly inconvenienced; normal routines disrupted. Minor damage to fittings and unstable objects. Some crop damage.	17
VI	Pronounced	Many people disturbed and some frightened. Minor damage to old or poorly constructed buildings. Transportation halted completely. Extensive crop damage.	25
VII	Very Pronounced	Everyone disturbed; many frightened. Event remembered clearly for many years. Considerable damage to poorly built structures. Crops destroyed. High livestock losses. Most people suffer financial losses.	65
VIII	Destructive	Many injured. Some panic. Numerous normal buildings severely damaged. Heavy loss of livestock.	80

APPENDIX IVB - continued

Event Intensity	Designation	Characteristics	Stressor Value
IX	Very destructive	Widespread initial disorganization. Area evacuated or left by refugees. Fatalities common. Routeways blocked. Agriculture adversely affected for many years.	100
X	Disastrous	Many fatalities. Masonry and frame structures collapse. Hazard-proofed buildings suffer considerable damage. Massive rebuilding necessary.	145
XI	Very disastrous	Major international media coverage. Worldwide appeals for aid. Majority of population killed or injured. Wide range of buildings destroyed. Agriculture may never be reestablished.	180
XII	Catastrophic	Future textbook example. All facilities completely destroyed; often little sign of wreckage. Surface elevation may be altered. Site often abandoned. Rare survivors become life-long curiosities.	200

(Foster, 1976, p. 244)

APPENDIX IVC

CALAMITY MAGNITUDE SCALE

10^{20}-20	
10^{15}-15	
	World War II
	Black Death
	World War I
10^{10}-10	
10^{9}- 9	
	Yungay Glacier Avalanche
10^{8}- 8	Managua Earthquake
	Iraq Fungicide Poisoning
10^{7}- 7	
	Halifax Munitions Explosion
	Darwin Cyclone Tracy
10^{6}- 6	
	Titanic Sinking
10^{5}- 5	Modane Train Crash
10^{4}- 4	Japanese Skiing Bus Drownings
10^{3}- 3	Fatal Car Accident
	Death From Natural Cause
10^{2}- 2	
	Jail Term
	Parking Ticket
10^{1}- 1	

(Foster, 1976, p. 246)

APPENDIX V

(SAMPLE COVER LETTER)

Dear ____________________,
(use name)

Your community has requested medical aid from the Air Force to help with injuries sustained in the recent ________________________. In order to learn how
(specify disaster)
we can effectively help similar communities suffering disaster, we request your help in obtaining information.

By the end of the week you should be receiving a questionnaire packet asking you questions about yourself, your disaster experience and your health. <u>All information is strictly voluntary and will be held confidential</u>. These forms should take about 15 minutes to complete, and you will be supplied with a postage-paid, return envelope.

For purposes of this survey we are asking that you complete some identifying information; please be assured that this will be used for analysis only. The file correlating you with your identifying number will be under lock and key--and will be destroyed at the end of the study.

You will be mailed similar follow-up health surveys at 2 month, 6 month, 1 year, 2 year and 3 year

-2-

intervals. You are free to withdraw from participation at any time. However, we have tried to assure that this check list will take no more than 5 minutes to complete; and your five minutes would help us and your community immensely!

If you have any further questions, please call ______________________________ (telephone number). If you foresee any problems in filling out the questionnaires, we will be glad to come to your home to assist you.

We greatly appreciate your help in this survey. A summary of the study results will be provided to your public library.

Very sincerely,

APPENDIX VI

PROPOSED BUDGET SHEET

Activity	Personnel	Supplies
Planning - I	6 EHNs, one from each MAJCOM Statistician Data Processor	Meeting Room Overhead Projector Access to Computer terminal
	Estimated time: 3 day TDY (at centrally located base)	
Planning - II	1 EHN Statistician Data Processor Secretarial	Autovon phone Postage Office supplies File cabinet Combination-lock safe
	Estimated time: 6 weeks	
Printing	Base reproduction	Paper
	Estimated time: one month	
Pretest and Re-evaluation	1 EHN 1 EH tech Secretary Data processor Statistician	Autovon phone Postage Paper Computer time
	Estimated time: one month	
Training preparation	1 EHN Secretarial Base reproduction	Office supplies Transparencies Postage
	Estimated time: 3 weeks	
Training	6 EHOs Epidemiologist consult	Meeting rool Overhead projector Training packet
	Estimated time: 2 day TDY	

APPENDIX VI - Continued

Activity	Personnel	Supplies
(At the scene:)		
Community assessment	2 EHNs 2 EH techs	4 desks 2 phones 1 staff car 2 typewriters Office supplies File cabinet Bulletin board Large map
	Estimated time: 2 days	
Drawing sample	same as above Secretary	same as above FEMA and ARC victim lists Local phone directory Combination lock Safe
	Estimated time: 3-5 days	
Sending questionnaires Answering questions Home visits	1 EHN 1 EH tech Secretary Telephone consult with Epidemiologist	same as above permission letter questionnaires postage envelopes Autovon phone
	Estimated time: 2 weeks	
Data processing	1 EHN Data processor Secretarial Statician	Computer time Office supplies Autovon phone Postage
	Estimated time: 4-6 weeks (after each time interval)	
Report preparation (at end of year 3 & 4)	6 EHNs Secretary Statistician Epidemiologist	Meeting room Overhead proj. Office supplies Autovon phone
	Estimated time: 1 week TDY plus 3 weeks phone consult	

APPENDIX VI - Continued

Activity	Personnel	Supplies
Prepare for publication	Chief EHN, MAJCOM Chief EHN, USAF 2 EHNs Secretary Epidemiologist Base reproduction	Autovon phone File cabinets (2) 3 typewriters
	Estimated time: 3 months for preparation; 1 week TDY consultation; 3 months approval and authorization time	

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